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April 9, 2004

Mail Stop Patent Application
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

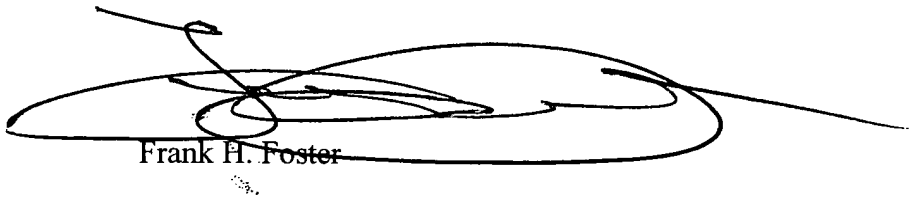
Re: Disclosue Document
Title of Invention: Method And System For Centering A Workpiece On The Central Axis Of A Cylindrical Bore
Our File No.: SUN 6150

Honorable Sir :

The subject matter of the patent application enclosed herewith is related to the contents of the below-identified Disclosure Document and it is requested that the Disclosure Document be retained by the U.S. Patent and Trademark Office in the file for the enclosed patent application.

Disclosure Document No.: 514674
Filed: July 8, 2002
For: Assembly Alignment System For Free-Piston Machines

Very truly yours,



Frank H. Foster

FHF/db

Enclosure: Copy of filed disclosure document

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Disclosure Document Deposit Request

DISCLOSURE DOCUMENT NO.

514674

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THIS IS NOT A PATENT APPLICATION

PTO-1652 (8/99)

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Mail to:
Box DD
Assistant Commissioner for Patents
Washington, DC 20231

Inventor(s): Floyd Largent, David Weeks, Robert Wiseman

Title of Invention: Assembly alignment system for free-piston machines

Enclosed is a disclosure of the above-titled invention consisting of 1 (one) sheet of description and 0 (zero) sheets of drawings. A check or money order in the amount of $10.00 is enclosed to cover the fee (37 CFR 1.21(c)).

The undersigned, being named inventors of the disclosed invention, requests that the enclosed papers be accepted under the Disclosure Document Program, and that they be preserved for a period of two years.

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NOTICE OF INVENTORS

It should be clearly understood that a Disclosure Document is not a patent application, nor will its receipt date in any way become the effective filing date of a later filed patent application. A Disclosure Document may be relied upon only as evidence of conception of an invention and a patent application should be diligently filed if patent protection is desired.

Your Disclosure Document will be retained for two years after the date it was received by the United States Patent and Trademark Office (USPTO) and will be destroyed thereafter unless it is referred to in a related patent application filed within the two-year period. The Disclosure Document may be referred to by way of a letter of transmittal in a new patent application or by a separate letter filed in a pending application. Unless it is desired to have the USPTO retain the Disclosure Document beyond the two-year period, it is not required that it be referred to in the patent application.

The two-year retention period should not be considered to be a "grace period" during which the inventor can wait to file his/her patent application without possible loss of benefits. It must be recognized that in establishing priority of invention an affidavit or testimony referring to a Disclosure Document must usually also establish diligence in completing the invention or in filing the patent application since the filing of the Disclosure Document.

If you are not familiar with what is considered to be "diligence in completing the invention" or "reduction to practice" under the patent law or if you have other questions about patent matters, you are advised to consult with an attorney or agent registered to practice before the USPTO. The publication, *Attorneys and Agents Registered to Practice Before the United States Patent and Trademark Office*, is available from the **Superintendent of Documents, Washington, DC 20402.** Patent attorneys and agents are also listed in the telephone directory of most major cities. Also, many large cities have associations of patent attorneys which may be consulted.

You are also reminded that any public use or sale in the United States or publication of your invention anywhere in the world more than one year prior to the filing of a patent application on that invention will prohibit the granting of a patent on it.

Disclosures of inventions which have been understood and witnessed by persons and/or notarized are other examples of evidence which may also be used to establish priority.

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Burden Hour Statement: This collection of information is used by the public to file (and by the USPTO to process) Disclosure Document Deposit Requests. Confidentiality is governed by 35 USC 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed Disclosure Document Deposit Request to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

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To FRANK FOSTER	From Frank Knutson	
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Date: 2/20/2002
Disclosure: Assembly alignment system for fre

The system is used in the assembly of the free piston machines. The requirement for the assembly process is to position the piston(s) within the cylinder in such a way as to minimize the radial loading on the linear bearings. This method requires the cylindricity, coaxiality, and diameters of the inner and outer cylindrical surfaces to all be within tolerance. This method achieves the critical assembly alignment by first establishing the axis of the cylinder as a reference target and then positioning the axis of the moving piston coincident with the target axis. The method by which this alignment is achieved is described as follows:

The piston cylinder axis is located by using a precision, close fitting arbor that is positioned in the piston cylinder. The arbor has a reference pin that extends out of the cylinder and is coaxial with the setup arbor. The reference pin is a projection of the cylinder axis and is a true indication of the cylinder axis within the limits of the arbor-to-cylinder diametrical fit and axis-to-axis coaxiality of the reference pin to the arbor. Position transducers register the position of the reference pin, and the diameter of the reference pin. Data from the position transducer is sent to a computer. The computer calculates and stores the cylinder axis position. A display is used to display the axis position as a target. The arbor is removed from the cylinder. The piston(s) is inserted into the cylinder. Position transducers register the position and diameter of a reference surface on the piston and transmit the data to the computer. The computer displays a point which indicates the position of the axis of the reference surface relative to the target position that was established with the arbor. The piston(s) is moved until the displacer rod axis position indicator coincides with the target indicator, within a predetermined tolerance. The piston position is then secured with the fastening mechanism.

Inventors:

Floyd Largent
Dave Weeks
Robert Wiseman

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